SCIENCE

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THE RED CROSS AND THE ANTIVIVISECTIONISTS:

AN APPEAL TO THE FAMILIES AND FRIENDS OF OUR HEROIC TROOPS AND TO THE COMMON SENSE OF THE AMERICAN PEOPLE

FIRST of all let me make two facts clear.

1. This paper has been written entirely on my own responsibility and not at the suggestion directly or indirectly of the Red Cross. I have been moved to write it solely in the interest of our brave soldiers, and especially because their sufferings and lives are involved in the suit against the Red Cross by the antivivisectionists to prevent the use of $100,000 of the Red Cross funds in such beneficent life-saving researches.

2. The Red Cross as an organization is neither an opponent, nor an advocate, nor a defender, of vivisection. It states officially that the *supreme* aim of the Red Cross is to *relieve human suffering* [and it might well have added "and to save thousands of human lives"].

The War Council was advised from the ablest sources available that an immediate appropriation for medical research would contribute to that end. The War Council could not disregard such advice.

They then refer to the many unsolved medical and surgical problems that have arisen from wholly new conditions and methods of warfare. Letters from a number of my own surgical friends in France emphasize and the medical journals teem with papers on these new problems. They relate to the treatment of the horribly infected wounds—and practically *all* wounds are of this kind—never met with in civil surgery; to the treatment of "trench

fever''—a peculiar form of fever never before seen; of ''trench heart''; of ''trench foot,'' often followed by lockjaw; of ''trench nephritis'' (inflammation of the kidneys); gas gangrene; tetanus; shell shock; poisonous gases; fearful compound fractures, especially of the thigh, etc. Every man enabled to return to active duty as a result of solving these problems helps to win the war. Every man who dies, or is permanently disabled because of our ignorance, hinders our winning the war.

It must be remembered that our surgeons, physicians and physiologists over there are the very flower of the American medical profession. These fine men under the supervision of the Medical Staff of the United States Army, superintend all the work. Nothing is done that has not the direct approval of Brigadier General A. E. Bradley, U. S. Army.

Experiments on animals form a necessary but a minor feature of the researches.

The animals used are principally guinea-pigs, rabbits and white rats. If operations causing pain to animals are performed, anesthesia is used.

This certainly does not suggest ''cruelty'' or ''torture.''

I appeal to the common sense of the American people and especially to the families and friends of our brave soldier boys: Which do you prefer (1) That our soldiers shall be protected from attacks of these new (as well as of the familiar) diseases, their sufferings lessened or even prevented, and their lives saved, or (2) will you insist that not a single guinea-pig, rabbit or rat shall suffer the slightest pain or lose its life, in researches to lessen the suffering and save the lives of our soldiers?

Remember, if you choose the second you deliberately condemn your son, brother, or husband to sufferings far beyond any suffering of these animals. In many cases, as I shall show, you will condemn your dear one to death, and in some cases a horribly painful death.

In the ''Bill of Complaint'' of the Anti-vivisectionists, seven grounds of opposition to vivisection are mentioned. The sixth reads as follows:

That although it [vivisection] has been practised for many years, *nothing has been discovered by means of it that is at all beneficial to the human race.*

This is the crux of the whole matter. If this were true I would vigorously oppose vivisection myself.

I entered upon my medical studies in 1860. I took part in the horrible surgery of the Civil War—as we now know it was. I have taught anatomy and surgery to not far from 10,000 students. I taught and practised the old dirty surgery—the only kind we then had—up to October 1, 1876. Since that date I have practised and taught the new antiseptic surgery, which has been created by researches similar to those now proposed. Since the great war began I have diligently studied the newest surgery. I submit, therefore, that I may be presumed to be fairly familiar with these three stages of surgery. Let me give now a few examples of some of the things that HAVE ''been discovered by it [vivisection]'' and that ''*are* beneficial to the human race.''

I may remark in passing that animals themselves have benefited by the same means, almost, and possibly quite as much as the human race.

1. *Typhoid Fever.*—This has been one of the historic scourage of armies. In 1880 the bacillus—the cause of the fever—was discovered. It was soon proved that the disease was spread through infected milk, infected water, and very largely by the house-fly. The last, after walking over the excrement of a typhoid patient, and then walking over our food, conveyed the dis-

ease. Prevention of contamination by these three means—sanitary measures based on the discoveries of bacteriology prevent the disease to a large extent. But our real triumph over the disease was not achieved until lately.

I may here call attention to the fact that the antivivisectionists entirely reject bacteriology, a science which has disclosed to us the causes of many diseases, and has enabled us to prepare antitoxins to neutralize the poisons developed by these bacteria. Without bacteriology the physician and the surgeon to-day would be as helpless as a mariner without a compass.

	Cases		Deaths
During the Civil War typhoid fever resulted in.....	79,462	and	29,336
In the Boer War there were..	58,000	"	8,000
(In that war the total number of deaths was 22,000. Typhoid alone, therefore, was responsible for more than one third of all the deaths!)			
In our war with Spain there were	20,738	"	1,580
Our Army numbered 107,973 men. Therefore every fifth soldier fell ill with typhoid in 1898! Over 86 per cent. of *all* deaths in this war were due to typhoid!!			

During the Boer War imperfect attempts were made to control typhoid by an antitoxin similar to that against diphtheria, which has saved such multitudes of children. Gradually the method has been improved so that in our army it was at first recommended as a voluntary protection (1909). The results were so favorable that in 1911 it was made compulsory. It has been said that it should still be voluntary. But as every case of typhoid imperils the health and life of multitudes we surely have a right to make it compulsory so as to protect all the rest. All that is necessary to prove this is to look at these tables of cases and deaths in our Army and Navy.

TYPHOID FEVER IN THE UNITED STATES ARMY

Year	Cases	Deaths
1906	210	12
1907	124	7
1908	136	11
1909	173	16
ANTI-TYPHOID VACCINATION MADE COMPULSORY		
1911	70	8
1912	27	4
1913	4	0
1914	7	3
1915	8[1]	0
TYPHOID FEVER IN THE UNITED STATES NAVY		
1909	189	17
1910	193	10
1911	222	15
ANTI-TYPHOID VACCINATION MADE COMPULSORY		
1912	57	2
1913	22	4
1914	13	0
1915	15	1

On the Mexican border, though the fever was rife near the camps, only *one man* out of 20,000 troops, a civilian, who unfortunately escaped vaccination, fell ill with it.

Now let us see the results in the armies in the present war.

In the British armies, on March 1, 1917, Mr. Forster, Under Secretary for War, stated in the House of Commons that

> The last weekly returns showed only twenty-four cases in the four British armies in France, Salonica, Egypt and Mesopotamia. He added that the total number of cases of typhoid fever in the British troops in France down to November 1, 1916, was 1,684, of para-typhoid,[2] 2,534, and of indefinite cases, 353, making a total of 4,571 of the typhoid group.

Now the English armies number at least 5,000,000. If they had suffered as our

[1] Four in the United States; 4 in Hawaii.

[2] A form of fever caused by a bacillus somewhat similar to the typhoid bacillus but causing a much milder infection.

Army did in 1898 there would have been 1,000,000 cases! In fact there have been less than 4,600! Besides that, the percentage of fatal cases in the inoculated men was 4.7 per cent., in the uninoculated 23.5 per cent.; and perforation of the bowel, the most dangerous complication, occurred *six times more frequently* among the unvaccinated than among those who had been protected. In the British armies the antityphoid vaccination is still voluntary but over 90 per cent. are thus protected. If it had been compulsory, hundreds of the 4,571 *who died would have been saved!*

In our own army in over four months (September 21, 1917, to January 25, 1918) a period one month longer than our war with Spain (the Surgeon General's Office gives me the official figures), we have had an average (*i. e.*, every day of these four months), of 742,626 men in our cantonments and camps. These men have come from all over the country, in many cases from where autumnal typhoid was reaping its annual harvest, in practically all cases unprotected by the vaccination. Between these two dates there have been 114 cases of typhoid and 5 of paratyphoid. *Had the conditions of 1898 prevailed there would have been 144,506 cases instead of 119 in all!* The reason is clear. The men were all immediately vaccinated against typhoid, paratyphoid and smallpox.[3]

Besides this as soon as the antityphoid inoculation was completed the number of cases rapidly fell and from December 14 to January 25—6 weeks!—there have been only 6 cases of typhoid and one of paratyphoid among probably now nearly 1,000,000 men! Truly marvellous!

Now all this is the *direct result of bacteriological laboratory work.* Was it not worth while? Has it not "benefited the human race"? Are you not glad that *your* son is thus protected?

I may add that the German armies show a similar absence of typhoid. I have seen no figures but only general statements.

Tetanus or "Lock-jaw."—Few people realize what terrible suffering this disease causes. The mind of the patient is perfectly clear, usually to the very end, so that his sufferings are felt in their full intensity. All of my readers have had severe cramps in the sole of the foot or calf of the leg. The pain is sometimes almost "unbearable." In tetanus not the muscles of the jaw alone are thus gripped, but the muscles all over the body are in cramps ten or twenty fold more severe, cramps so horrible that in the worst cases the muscles of the trunk arch the body like a bridge and only the heels and the head touch the bed!

> Never shall I forget a fine young soldier during the Civil War who soon after Gettysburg manifested the disease in all its dreadful horror. His body was arched as I have described it. When at intervals he lay relaxed, a heavy footstep in the ward, or the bang of a door, would instantly cause the most frightful spasms all over his now bowed body and he hissed his pitiful groans between tightly clenched teeth. The ward was emptied, a half-moon pad was hung between the two door-knobs to prevent any banging; even the sentry, pacing his monotonous steps just outside the ward, had to be removed beyond earshot. . . . The spasms became more and more severe, the intervals shorter and shorter; it did not need even a footfall now to produce the spontaneous cramps, until finally a cruelly merciful attack seized upon the muscles of his throat and then his body was relaxed once more and forever. He had been choked to death.

Do you wonder at the joy unspeakable which we surgeons have felt of late years as we have conquered this fearful dragon? In 1884 the peculiar germ, shaped like a miniature drum-stick, was discovered. Its home is in the intestines of animals, especially of horses. The soil of France and

[3] Of the latter disease there have been only 4 cases, all unvaccinated.

Belgium has been roamed over by animals and manured for over 2,000 years, even before Julius Cæsar conquered and praised the Belgians. The men in the trenches and their clothing are besmeared and bemired with this soil, rich in all kinds of bacteria, including those of tetanus, gas gangrene, etc. When the flesh is torn open by a shell, ragged bits of the muddy clothing or other similarly infected foreign bodies are usually driven into the depths of the wound. Now the tetanus bacilli and the bacilli of "gas-gangrene" are the most virulent of all germs. It takes 225,000,000 of the ordinary pus-producing germs to cause an abscess and 1,000,000,000 to kill, while 1,000 tetanus bacilli are enough to kill. This readily explains the frightful mortality of tetanus during the Civil War. It killed 90 patients out of every hundred attacked.

In the early months of the Great War the armies suddenly placed in the field were so huge that there was not a sufficient supply of the antitoxin of tetanus. Hence a very considerable number of cases of tetanus appeared. Now it is very different. At present every wounded soldier, the moment he reaches a surgeon is given a dose of antitetanic serum. As a result, *tetanus has been almost wiped off the slate.* I say "almost," because to be effective the serum must be given within a few hours. The poor fellows who lie for hours and even days in No Man's Land can not be reached till too late. All the surgeons on both sides concur in saying that tetanus, while it still occurs here and there, has been practically *conquered.*

Every step of this work has been accomplished by the bacteriologists and the surgeons working together in the laboratory and the hospital.

Would you seriously advise that no such experimental researches should have been carried on and that your boy should suffer the horrible fate of my own poor Gettysburg boy? Confess honestly, are not these and other similar researches to be described as humane?—as desirable?—nay, as imperative?

But the antivivisectionists declare that bacteriology is false—that such vaccination is "filling the veins with 'scientific filth' called serum or vaccine"! They are doing their best to persuade our soldiers not to submit to any such "vaccination"!

Nay, more "we feel," say forty-one of our medical officers on duty in France, "that any one endeavoring to stop the Red Cross from assisting in its humanitarian and humane desire to prevent American soldiers from being diseased, and protecting them by solving the peculiar new problems of disease with which the Army is confronted *is in reality giving aid and comfort to the enemy.*"

Small-pox.—The word vaccination leads me to say a word about small-pox. I confess that I *was* amused by a recent paper in an antivivisection journal entitled "Vaccination as a *Cause* of Small-pox"! During the last year hundreds of thousands of soldiers have been vaccinated against small-pox. Surely there should have been *some* cases of that disgusting disease if it were caused by vaccination.

But what are the facts? I have just received the Report of Surgeon General Gorgas for 1917. The section on Small-pox reminds one of the celebrated chapter on "Snakes in Ireland." On p. 81 on Small-pox in the Army in the United States, I read "*No* cases of small-pox occurred within the United States proper during the year." On p. 175, I read "*No* cases [of small-pox or varioloid] occurred in the islands" [among the American troops in the Philippines]. On p. 188, I read under Small-pox that "nine cases occurred

during the year'' [among the Philippine Scouts].

My friend and former student, Dr. Victor G. Heiser, as director of health in the Philippine Islands for years, vaccinated over 8,000,000 persons without a death—and with what result? In and around Manila the usual toll of small-pox had been 6,000 deaths and about 25,000 cases annually. In the twelve months after his vaccination campaign was finished there was *not one death* from small-pox.

Per contra, in 1885 in Montreal, as stated by Osler, one Pullman porter introduced small-pox into a largely *un*vaccinated city. There followed 3,164 deaths and enormous losses to the Montreal merchants.

But why say more? We all know that a single case in any community causes every intelligent person to be protected by vaccination.

Gas-Gangrene.—One of the terrible and new surgical diseases developed by this war is called ''gasgangrene.'' It has no relation to the poisonous gases introduced by the barbarous Germans at Ypres. About twenty-five years ago Professor W. H. Welch, of the Johns Hopkins Hospital, discovered a bacterium which *produced gas* in the interstices between and in the muscles. This bacillus does not occur in Great Britain. I never saw a case of gasgangrene in the Civil War, and but one case since then in civil practise. On the contrary in Belgium and France in the soil and, therefore, on the clothing and on the skin of the soldiers these bacilli abound. From what Bashford calls the ''cess-pool of the wound'' the germs travel up and down in the axis of the limb. If it escapes from a puncture it will take fire from a match. Gas has been observed within five hours. An entire limb may become gangrenous within sixteen hours. If the whole limb is amputated the gas may be so abundant that the limb will float in water! Death is not long delayed.

Now your son in France runs a very serious risk of becoming infected with this deadly germ. Would you be willing positively to forbid any experiments on animals which could teach us how to recognize this infection as early as possible? Would you forbid any experiments which might teach us how to *conquer* or better still to *prevent* this virulent infection and save his life? Which would you prefer should suffer and very possibly die, a few minor animals or your own son? If a horse or a dog or even a tiny mouse can help in this sacred crusade for liberty and civilization, if it even suffers and dies, is it not a worthy sacrifice? Should they be spared and our own kith and kin give up their lives?

I need not wait for a reply! I am sure you would say ''My boy is worth 10,000 rabbits or guinea-pigs or rats! Go on! Hurry, hurry! and find the remedy.'' That is *true* humanity which will save human lives even at the expense of some animals' lives.

Now see the result. By careful observa tion and experiments with different remedies the surgeons have discovered valuable methods of treatment. But very many still die. *Prevention* is always far better than cure. At the Rockefeller Institute Drs. Bull and Ida W. Pritchett have discovered a serum which in animals *prevents* this gasgangrene and yet does no harm to the animal. It is now being tried on the soldiers in France.

Again I ask: Is it not our duty even to *insist* on such experiments so that our troops may be spared the dreadful suffering and even death following this virulent infection? If the Bull-Pritchett serum proves ineffective should not our efforts be redoubled? The common sense of the

American people will reply: "Yes, by all means. You will be recreant to humanity and to your duty if you do not."

Modern Surgery.—"Lister," in Howard Marsh's fine phrase "opened the gates of mercy to mankind." Pasteur and Lister are the two greatest benefactors of the human race in the domain of medicine. I am not sure but that I might even omit the last five words.

The *revolution* which Lister produced in surgery is so well known to every intelligent person that I need only say a few words. Forty years ago a wholly new surgical era was inaugurated by Pasteur and Lister. In the Civil War there were recorded 64 wounds of the stomach and only *one* recovered. Otis estimated the mortality at 99 per cent. In over 650 cases of wounds of the intestines there were only five cases of recovery after wounds of the small bowel and 59 from wounds of the large bowel—together only 64 out of 650 recovered, *i. e.*, over 90 out of every 100 died!

The complete statistics of the present war can not be tabulated and published for some years. I give, however, the result of one series of abdominal gunshot wounds as a contrast, on a far larger scale and in far worse wounds. Out of 500 such operations, 245 *recovered!* and only 255 died! Contrast 51 per cent. of deaths in these wounds with mutilation and infection unutterably worse than in the Civil War, with 99 per cent. of deaths, according to Otis.

Is not this a triumph of bacteriological and surgical research? Would you prohibit similar researches now when your boy's life may be saved by them?

Is not this one of the things that *have "been discovered"* by vivisection and has not such change in surgical treatment been of *"benefit* to the human race"? In all honesty would you be willing to have your son treated as I myself (may God forgive me!) ignorantly treated hundreds during the Civil War?

This advance I do not *think* or BELIEVE, but I KNOW is due to Pasteur and Lister and their followers. I know it by personal experience just as you know the high cost of living, the shortage of sugar and the scarcity of coal.

The bacteriology which the antivivisectionists scorn and reject I KNOW is the CORNERSTONE of modern surgery. Before Lister's day out of 100 cases of compound fracture 66 died from infection. Now *less than one* out of 100 die. Before Lister my old master in surgery, Dr. Washington L. Atlee, one of the pioneers in practising ovariotomy, lost two out of every 3 patients—now only two or three in a hundred die. Before Lister we never *dared* to open the head, the chest or the abdomen unless they were already opened by the knife, the bullet or other wounding body. Now we open all of these great cavities freely and do operations of which the great surgeons of the past never dreamed in the wildest flights of their imagination. Could they return to earth they would think us stark crazy until they found that the mortailty was almost negligible and the lives saved numbered hundreds of thousands.

I have given but a few instances of the many wonderful benefits which have resulted from medical research in every department of medicine. But I believe they are sufficiently convincing. I can sympathize with the deep feelings of those who wish to spare pain to animals, but is it not a higher and more imperative, a holier sympathy that has spared and will spare pain eventually to human beings and also to other animals in uncounted numbers?

Do you wonder that after over forty years of steady practise, teaching and writing I assert, conscious of the great responsi-

bility of my words, that "I regard experimental research in medicine as a medical, a moral and a Christian *duty* towards animals, towards my fellow men and towards God."

There is so much yet to be learned chiefly, by experimental research. So many devoted lives to be saved to our country and to mankind if we only knew how! Do you wonder that I am in dead earnest?

Finally. What have the antivivisectionists themselves done to diminish sickness and save life?

A. In animals? Absolutely nothing.

In spite of the enormous ravages of animal diseases causing enormous suffering to animals and costing this country $215,000,000 every year, not a single disease has had its ravages diminished or abolished as a result of anything *they* have done. But medical research is saving every year thousands of animals from anthrax, hog cholera, chicken cholera, Texas fever and other diseases.

B. In human beings? Absolutely nothing. I do not know a single disease of human beings which has had its ravages checked, abated or abolished by any work ever done by the antivivisectionists.

The only thing they *have* done has been to throw as many obstacles as possible in the path of those who are striving to benefit both animals and men.

This present suit is characteristic.

W. W. Keen

Emeritus Professor of Surgery,
Jefferson Medical College and
Major in the Medical Reserve Corps,
U. S. Army

SOME OPINIONS ON COLLEGE PHYSICS TEACHING

Originally the whole of science, physics has come by specialization to have for a central interest the relations of energy to matter, motion, heat and electricity; it lies, not sharply bounded, among astronomy, chemistry, the biological and earth sciences, and their applications in engineering and agriculture. From it all these draw fundamental data, and from it new branches continually develop. The history of this development is very interesting and instructive; it forms one phase of the intellectual development of humanity, and should be known to all students whose interests are at all higher than the bread-and-butter level.

It has been said that science is common sense. That is incompletely true; for *common* sense results from *common* experience, and can hardly deal with uncommon or new situations. From this arises one of the difficulties which to many people make physics a repulsive subject. It deals with facts of all sorts, from bearing friction and the flow of water in pipes to the flight of wireless waves and the rotation of nebulæ, and has to adopt a viewpoint which can not be that of common experience; for observations on most of this vast range are not commonly made, and not by common people. Newton's three laws of motion, for example, are not expressions of common sense; otherwise they would not have been reserved for Newton to state. They are known not to be in conflict with common experience; they include it; but the average person has not had the uncommon astronomical and laboratory experiences necessary for their discovery or appreciation. Hence the mechanics based on them seems stale and dry, metaphysical, out of connection with experience.

The subject of physics being thus vast, not clearly defined and to a certain extent removed from common experience, only a part of it can be taught in elementary courses. What this part shall be has to be decided with an eye on two things; it must seem worth while to the student, and it must expand his horizon of experience, so that the great general laws which have been discovered shall seem to him to spring naturally from the behavior of matter. To seem worth while to a student, the subject-matter of a course must build upon what he already knows, and must have evident bearing upon the problems which he knows he will have to solve. He has had experience with crow-

bars, boats, automobiles, telephones; it is wise to start out with this knowledge and unify it; he knows he must solve problems in practise, with pulleys, hydraulic rams, cameras or wireless instruments; he should see that his physics is leading to an ability to do these things.

In mass teaching, such as teaching in most American institutions must be, the aim of the teacher must be at the average man in the class. The ground covered, the rate at which it is covered, and its relative difficulty, must depend on the ambitions of this average man; these can be determined only by "feeling of" the class, and change from year to year. While this matter is one too extensive for treatment here, it should be noted that the problem is by no means a simple one; the teacher is only one element in the competition of which the student is the center, and he and his course can not always hope to master the student's attention against the intense pressure of fraternities, games, "Wein, Weiber und Gesang." To play a part in this competition and win any real success implies that the teacher must realize the situation and be ready himself to exert a sensible pressure. The easy-going notion that they may take it or leave it—that's their business—is as much out of place in the teaching of physics as it is in the selling of hair-wash and automobiles. I believe that college administrations are more at fault in their ill appreciation of this than are college teachers, though something can be said on both sides.

The teaching methods usually adopted for elementary work are lectures, text-book study with problem-solving, and laboratory work. Each has its peculiarities, its limitations and difficulties.

Physics lectures are carried on with experiments, qualitative or semi-quantitative, which the audience observes under the guidance of the speaker, without having to supply skill or initiative. This method is the only one for the exposition of original research or recent progress; many experiments are valuable when taken up thus and less so otherwise; the more or less passive attitude of the audience is the great weakness. It does very well as an easy way for beginning or general classes; pedagogical tricks, like written notes and quizzes, help to diminish somewhat the somnolence due to passivity. However, every lecture is probably more valuable to the speaker than to any of his hearers. Every teacher who uses this method, and requires the completion of written notebooks on the course, should read some of these notebooks with some care. He will learn something about the value to the audience of his own lectures.

The presentation of lecture experiments is often weakened by inattention to the details of lighting. An experiment which only a few of the audience can see is wasted, however it may please the lecturer, for it is his business to "get it over" just as much as if there were footlights between him and his hearers. It is not enough to set the apparatus up—it must go; and it is not enough that the experiment go—the audience must see it; and weak lighting of the critical point, glitter and glare on glass surfaces, supports in the way, etc., sometimes hinder the audience from seeing. While the experiment is being tried out in advance the lecturer should view it from the audience space and from the most disadvantageous points, to correct such weaknesses.

The combined recitation and laboratory method makes greater demands on the members of a class than the lecture method. I do not believe that any student should be allowed to take a purely text-book course in elementary physics; the laboratory should invariably accompany the recitation.

The study of a book, the solution of problems, the answering of questions, give play to both originality and skill; book explanations and descriptions of experiments not only lead to an understanding of work performed in the laboratory, but they bring in order before the mind the results of experiments and observations which only a favored few can ever directly know because of difficulty, expense or length of time required.

The objects of laboratory work are two; to illustrate (not demonstrate) the laws of nature, and to teach the technique of experiment. This latter is apparently only secondary, but

without it experiments illustrate rather the fallibility of human nature than the laws of nature. Much time and effort must be given to it. It was formerly a common notion that in the laboratory the student should by himself rediscover the laws of nature, doing in a few youthful work periods what during two thousand years the greatest minds only gradually accomplished. Nobody thinks of that now; the laws of machines, of motion, of heat and electricity can only be illustrated, not discovered, in the student laboratory. The beginner has not only to make the illustrative observations, he must *learn how* to make them. The technique of observation is as real as that of the shop; just as in wood shop or forge or machine room the ways of handling materials and metals which experience has proved good are not only taught but insisted on, so the technique of the laboratory must be enforced; the setting up of apparatus, the making of measurements, the interpretation of the measurements, all these must be done according to good ways developed by experience. Hence there must be rather explicit directions for work placed in the hands of the student, dealing not merely with apparatus in general, but with the apparatus of the laboratory where the work is done. It is justly to be questioned whether general laboratory manuals are a success; were all laboratories equipped with the same patterns of apparatus it might be possible to write a manual which would serve them all; as the case is, different laboratories have such different equipments, inherited and constructed, that the detailed directions which the beginner must have are unique in each institution. This does not mean, of course, that manuals can not be written in book form (though I hold the loose-leaf system better, as more flexible), but that the book which fits the conditions of one place can hardly fit those of another.

Not only is the technique of observation the result of a long historical development; equally so is the technique of the interpretation of observations when made. For the elementary laboratory the experiment directions should be laid out with this in mind, and good methods of reduction and a reasonable standard of accuracy insisted on. Of course the degree of accuracy can not be very high—usually a tenth of a per cent. is very good for student work, and sufficient, in well-planned experiments, for the illustrations desired. Better than this is hardly to be expected, as the apparatus for beginners can not have many refinements, and must also be fairly fool-proof, if the staff is not to spend most of its time making repairs. For this degree of accuracy and for the purposes of illustration careful sliderule calculations and careful use of plotting paper are excellent in most cases; I have not found that the average student is any more able to learn the accurate use of these materials than he is of apparatus, unless he is obliged to take the pains, and taught how.

Since the object of the laboratory work is the illustration of the laws of nature, the interpretation of the results should not be made difficult by clouds of calculation, myriads of curves or apparatus planned badly for the purpose in hand. I have sometimes been obliged to force students through laboratory directions subject to these drawbacks, and the reading of their reports has driven me to the belief that simple experimental methods, direct and well-planned computations and the use of curves when curves are the shortest way to bring out the facts, are what they need to be taught with great pains. In the elementary laboratory busy work has no place. Particularly, I am sure that in some cases where students are forced to compute results by the method of least squares the labor is worse than wasted, as certain basic assumptions of the application are not justified in the conditions of the observations. The existence of such cases was pointed out in *Nature* a good many years ago; Merriman has dealt with their theory and computation; a glance at his paper will convince any one that such treatment has no place in the elementary laboratory.

When the student has got along in his knowledge of laboratory technique he should be set at problems which involve reading and advanced observation, but this should in general be called *research* only if the undergraduate is

to be flattered thereby. I am of the opinion that the use of precision instruments in the repetition of classical experiments would be for the advanced undergraduate much better than a good deal of the "research" which he carries on with a man at his elbow to show him how, and perhaps not worse for the teacher. The study and mastery of the original articles of a series of the classical experiments, and the supervision of the experimental work, would be highly valuable for any teacher of physics.

In these days of rising costs the teacher of physics, like all the rest, should have at heart the problem of waste in his administration. As I once heard Professor B. K. Emerson say to a student, in the course of a mild rebuke for mishandling a crystal specimen, a collection is meant to be used up, but not to be destroyed; and so with apparatus. I think that the best means to meet this problem is to hold every student personally responsible for the apparatus which is intrusted to him, by keeping a personal account with him. The plan of assessing all students at a flat rate for laboratory expenses, no matter who does damage, used to seem to me little better than highway robbery on the part of the laboratory, and I have no doubt that students feel the same now. The individual account is some trouble, to be sure, but it makes each man feel responsible and act carefully, as I can testify from experience.

WILLARD J. FISHER

WORCESTER, MASS.

SCIENTIFIC EVENTS

THE RAMSAY MEMORIAL FUND

AFTER the death of Sir William Ramsay in July, 1916, a memorial meeting was held in London to commemorate his thirty-five years of service in physical and chemical sciences, education and public welfare. As was noted in SCIENCE at the time, the gathering of distinguished men, under the chairmanship of Lord Rayleigh, decided

1. To raise a substantial fund as a memorial to Sir William; and
2. To use such fund for the establishment of
   (*a*) Ramsay Research Fellowships, tenable wherever necessary facilities might be available, and a
   (*b*) Ramsay Memorial Laboratory of Engineering Chemistry at the University of London, where Sir William served twenty-six of his most fruitful years of activity.

A committee of prominent men in the physical and chemical sciences in Great Britain, including the leaders of the Coalition government and Ambassadors then accredited to the Court of St. James, was later organized. Through this general organization, committees were organized in Australia, Canada, Chile, Denmark, Holland, India, Italy, Japan, New Zealand, Spain, Switzerland and the United States. Correspondence with men of science indicate the formation of National Committees also in China, France and Sweden, and perhaps Russia.

The sum set out to be raised was £100,000. To date something over £300 have been contributed by residents of the United States.

The merits of the objects of this fund are obvious. The recognition of a man who made so many valuable contributions to our knowledge and who won so many friends through his wonderful friendly sympathy and erudition appeals especially to American men and women.

The committee expects some generous contributions and will welcome the receipt of other large gifts, but it hopes especially to have a great number of small subscribers. The receipt of checks, postal orders, or cash, for one dollar or over, sent to the Ramsay Memorial Fund Association, 50 East 41st St., New York City, will be promptly acknowledged.

UNITED STATES COMMITTEE FOR THE RAMSAY MEMORIAL FUND

Walter Hines Page, *Vice-president*	Marston T. Bogert,
	Chas. F. Chandler,
Charles Baskerville, *Chairman*	Francis W. Clarke,
	Wm. D. Coolidge,
Wm. J. Matheson, *Treasurer*	John H. Finley,
	Edward C. Franklin,
Leo H. Baekeland,	Frank Hemingway,
Wilder D. Bancroft,	Chas. H. Herty,

Charles James,
George F. Kunz,
F. Austin Lidbury,
Arthur D. Little,
C. E. K. Mees,
R. A. Millikan,
Richard B. Moore,
Wm. H. Nichols,
William A. Noyes,
Henry Fairfield Osborn,
Charles L. Parsons,
Ira Remsen,
Theodore W. Richards,
Edgar F. Smith,
E. G. Spilsbury,
Julius Stieglitz,
Milton C. Whitaker.

THE WAR DEPARTMENT COMMITTEE ON EDUCATION AND SPECIAL TRAINING

The Secretary of War authorizes the following announcement:

With a view to mobilizing the educational institutions of the country and their facilities for special training, there has been created in the War Department a "Committee on Eduction and Special Training." Associated with this committee will be five civilian educators, known as an advisory board of educators.

The committee will be composed of Col. Hugh S. Johnson, deputy provost marshal general; Lieutenant Colonel Robert I. Rees, of the General Staff, and Major Grenville Clark, of the Adjutant General's Department.

The five advisory members of the committee, whose selection has been approved by the Secretary of War, are:

Dr. Charles R. Mann, of the Carnegie Foundation for the Advancement of Teaching, and the Massachusetts Institute of Technology.

Dr. James R. Angell, of Chicago, dean of the faculties of the University of Chicago.

Mr. J. W. Dietz, of Chicago, director of education, Western Electric Company, president of the National Association of Corporation Schools.

Mr. James P. Munroe, of Boston, a member of the Federal Board for Vocational Education (which appointment will include the interests of the trade schools and schools of secondary grade).

Dr. Samuel P. Capen, of the U. S. Bureau of Education, specialist in higher education.

In these appointments it is felt that the entire educational field has been covered, since Dr. Mann is representive of engineering schools, Dr. Angell is representative of academic colleges and universities, and Mr. Dietz is from the field of schools conducted by industrial concerns. The committee will be authorized to call in from time to time other educators for consultation and assistance.

The functions of this committee will be to mobilize the country's schools and colleges behind the Army. It will encourage and arrange for the technical education of men needed by the several branches of the Army, particularly the Ordnance Bureau, the Signal Corps and the Engineers. In a degree the educational institutions are already rendering patriotic service to the government, but it is planned that there shall be a systematization of their efforts and that their facilities for technical training shall be fully utilized.

The General Order of the War Department creating the "Committee on Education and Special Training," defines its functions in the following broad terms:

> Under the direction of the Chief of Staff the functions of the committee shall be: To study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country and to represent the War Department in its relations with such institutions; to administer such plan of special training in schools and colleges as may be adopted.
>
> It is ordered that the committee shall be given such assistance, commissioned and civilian, as may be necessary to fully execute its duties, with office room in the War Department Building.

It is estimated that within the next six months 75,000 to 100,000 men will be given intensive training in schools and colleges. These men will be drawn from the armed forces of the nation, the men now in training camps or about to be called thereto, and the registrants under the selective draft act. It is expected that most of the men selected for technical training will be taken from among the men who have registered under the selective draft law and who are awaiting training and the call to the colors.

In the selection of men for intensive training in technical subjects the committee will have available the information contained in

the questionnaires which have been filled out by registrants under the selective draft law, the records and knowledge of colleges and educators of young men whose aptitude for technical service may be utilized, and the classifications of men already in training camps which have been made by the classification committee headed by Professor Walter Dill Scott.

The great demand in this war for skilled men and technicians and for educated men in many lines has been apparent. Much splendid work for the army has been done by the educational institutions in the aviation ground schools and in training specialists for various branches of the service. The Federal Board for Vocational Education has also rendered substantial service. It is now proposed to mobilize more completely the educational institutions of the country and the great educational resources of the nation, to utilize them to the utmost, and to send a large number of men to colleges, educational institutions, at an early date for intensive training in army service on technical lines.

CHEMISTRY AND THE WAR

ADEQUATE chemical control of manufacturing plants engaged in the supply of war material is now receiving the careful consideration of the War Department. The experience of both Great Britain and France teaches the necessity of conserving the supply of trained chemists, at no time large, in order that the supplies upon which the winning of the war so largely depends may not be curtailed.

Provision has now been made through an order of the Adjutant General of the Army by which manufacturers of material necessary to the prosecution of the war, who have lost the services of chemists through the first draft, may again obtain the services of these men for war work.

It is announced, also, that provision has been made by which manufacturers threatened with the loss of their trained chemists in the present draft may retain these men. Only those chemists whose services are necessary to war work will be considered, and the evidence submitted by the manufacturer must be conclusive.

Manufacturers thus affected should apply to the Chemical Service Section, N. A., New Interior Building, Washington, D. C., for the regulations governing the transfer of men already drafted, or the possible reclassification of men not yet called. This request must come from the manufacturers; applications from the men will not be considered.

SCIENTIFIC NOTES AND NEWS

DR. ALONZO E. TAYLOR, professor of physiological chemistry in the University of Pennsylvania, will give the address at the forty-second anniversary of the opening of Johns Hopkins University on February 22.

SIDNEY J. JENNINGS, vice-president of the U. S. Smelting, Refining and Mining Co., has been elected president of the American Institute of Mining Engineers to succeed Philip N. Moore of St. Louis.

THE gold medal of the Royal Astronomical Society has been presented to Mr. John Evershed for his contributions to astrophysics.

THE following important changes made in the administrative organization of the United States Public Health Service are noted in the *Journal* of the American Medical Association. Surgeon J. W. Schereschewsky has been relieved at Pittsburgh and assigned for duty as assistant surgeon-general in charge of the Division of Scientific Research. Assistant Surgeon-General J. W. Kerr, who formerly held this position, has been assigned to the director of the Hygienic Laboratory for temporary duty. Surgeon B. S. Warren has been relieved from duty with the United States Employees' Compensation Commission and has been assigned as assistant surgeon-general in charge of the Division of Sanitary Reports and Statistics. Assistant Surgeon-General J. W. Trask, who held the latter position, has been assigned to the position vacated by Surgeon Warren. Assistant Surgeon-General W. C. Rucker, in charge of domestic quarantine, has been assigned for special temporary duty with the War Department in the British Isles and on the continent of Europe in connection with maritime quarantine for the prevention of the

introduction of quarantinable diseases into the United States.

Dr. F. C. Waite, professor of histology and embryology in the schools of medicine and of dentistry of Western Reserve University, has been recalled to Washington to assist Major H. D. Arnold, M.R.C., in a new division of the Surgeon General's office. This division is to have charge of medical, dental, and veterinary students who, under the provisions of the selective service act, are enlisted in the reserve medical corps and placed on inactive service until they finish their professional training. Any student who does not make satisfactory progress will be dropped from the reserve corps and become liable to call for immediate active military service. The division is also to have oversight of the medical, dental and veterinary schools in which those men are studying, and to determine what schools throughout the country are equipped to give satisfactory professional training for medical services.

Mr. William A. Hamor, of the Mellon Institute of Industrial Research, has been called into active service as a major in the foreign chemical service section of the army.

Major Basil C. H. Harvey, professor of anatomy in the University of Chicago, has recently joined Base Hospital No. 13 at Fort McPherson, Georgia, after having served six months at Camp Cody, New Mexico, in charge of the sanitation of the camp and of the planning of the rations. Major Harvey has also conducted an army medical school in Camp Cody for training men in sanitation.

Arthur W. Ewell, professor of aeronautics at the Worcester Institute of Technology, has been appointed a captain in the aeronautic branch of the Aviation Corps and assigned to immediate foreign service. He will be attached to General Pershing's headquarters for the purpose of studying bomb dropping.

Dr. F. C. Brown, professor of physics in the Iowa State University, has received a captaincy in the ordnance department and will go to Washington, D. C., to do special research work. Dr. Brown has worked on the determination of the velocity of bullets by electrical methods.

Professor Frederick B. Slocum, of the department of astronomy at Wesleyan University, has taken up nautical work for the government and will not return to college this year.

Neil M. Judd, since 1911 assistant in the department of anthropology, United States National Museum, has been granted indefinite furlough by the Smithsonian Institution. He returned to Washington early in October, after seven months' explorations in the southwest, and shortly thereafter enlisted as a flyer in the Signal Reserve Corps.

The *Minnesota Alumni Bulletin* states that Professor Francis Jager, chief of the bee division of the agricultural department of the University of Minnesota, has been granted six months' leave of absence to head a group of men who are to go to Serbia and direct farming operations on a large tract of land. Preparations have been made and negotiations practically completed for a boat to transport machinery, seed and all the necessary equipment for the task.

T. Ralph Robinson has been appointed crop physiologist in the Bureau of Plant Industry and will be associated with Walter T. Swingle in the administration of the office of crop physiology and breeding investigations and especially in the breeding of hardy and disease resistant citrous fruits and stocks. Mr. Robinson formerly belonged to the bureau staff when he worked chiefly on soil bacteriology and water supply purification, but for a number of years he has been engaged in citrus culture in Florida.

Rev. Harry R. Caldwell has been elected to life membership in the American Museum of Natural History in appreciation of his gift to the museum of a collection from China of about 8,000 insects, and of his assistance to the Asiatic Zoological Expedition during its recent work in Yunnan. Professor C. R. Kellogg has been made a life member in acknowledgment of his aid to the Asiatic Zoological Expedition and his continued interest in the development of the museum. Dr. William

Diller Matthew has also been elected to life membership in recognition of his many services to the museum and of his scholastic attainments.

REAR ADMIRAL COLBY M. CHESTER, professor of naval science, will deliver to the members of the Yale Naval Training Units and others interested, a series of lectures on international law, and other naval subjects on February 11 and 18 and on the first and third Monday evenings of succeeding months.

PROFESSOR JOSEPH FREDERIC KLEIN, dean of the faculty and head of the department of mechanical engineering of Lehigh University for thirty-seven years, died suddenly on February 1.

DR. HENRY MAUDSLEY, the distinguished British alienist and psychologist, has died at the age of eighty-three years.

SIR JOHN WOLFE BARRY, the eminent British civil engineer, died on January 22, in his eighty-second year.

SIR ALEXANDER MEADOWS RENDEL, known for his important engineering work on docks and railways in England and in India, has died at the age of eighty-eight years.

DR. WILLIAM GREENWELL, F.R.S., of Durham, known for his publications on archeology, died on January 27 in his ninety-eighth year.

MISS ETHEL SARGANT, the English botanist, died suddenly at Sidmouth, on January 16, at the age of forty-five years.

DR. MARYAN SMOLUCHOWSKI DE SMOLAN, professor of physics at the University of Cracow, known for his work on thermodynamics, has died at the age of forty-five.

THE *Journal* of the American Medical Association states that Dr. C. P. Emerson, dean of the Indiana University School of Medicine, has consulted with Governor Goodrich in regard to the construction of the new school of medicine to be built on the grounds of the Robert W. Long Hospital. The estimated cost of the new building is $365,000. The present plan is for the state to buy the old medical college building at approximately $150,000, and for the university to pay the remainder of the cost of the new building.

THERE is reported to be strong probability of the location in St. Louis of a reconstruction hospital as a government war institution. A site of fourteen or more acres has been tendered to the government by the municipal authorities, along with such other assistance as may be rendered by the city. It is in Forest Park, adjacent to Barnes Hospital and the Washington University Medical School, the facilities of both these institutions also being at the disposal of the national authorities, as are also those of St. Louis University. Preliminary work by the two universities embraced a broad survey of the essential advantages of St. Louis for a hospital of the nature stated, the purpose of which is to fit disabled but convalescent soldiers for maintaining themselves, by training them in the line of work best suited to their mental and physical condition. Cooperation also is to extend to finding employment for the men, and to this end the survey included industries in which would be found opportunity for the trained. The hospital, if established as seems probable, will have a capacity of 1,000 or more soldiers, and it will be under direct supervision of the national government and maintained by it. Men to be treated and instructed will enter the institution under assignment, and the entire staff will be selected from Washington. It is understood that these hospitals are to be established in several of the larger cities where are to be found the facilities in which St. Louis abounds.

THE American Museum, as we learn from its *Journal,* has offered to the National War Work Council of the Young Men's Christian Association the choice of any of its thousands of miscellaneous lantern slides which may be found suitable for the entertainment of soldiers in camp, either in this country or abroad. A cable received from France by the War Work Council asked for as many colored slides as possible, with a range of subjects embracing architecture, art, science, war and the scenery of various countries. The museum is preparing also a series of lectures to be circulated among the camps. Four of these now in course of preparation are: "Hunting Elephants and

Other Big Game in Africa," by Carl E. Akeley; "Whale Hunting with Gun and Camera," by Roy C. Andrews; "Down the River of Doubt with Colonel Roosevelt," by George K. Cherrie, and "Bird Life on an Antarctic Island," by Robert Cushman Murphy. The manuscript of each lecture will be accompanied by about one hundred slides. The lecture, prepared in the first person, may be read before the soldiers with the same effect as if given at first hand. Another plan of the American Museum for providing relaxation and recreation for the soldiers, is the loan of some of the best of its motion picture films, such as the Crocker Land material and the travel films of Japan and China taken by Roy C. Andrews. These will be so fully titled and captioned that they will be self-explanatory.

Beginning with the present month the Geographic Society of Chicago will issue its monthly announcements in serial form. While the publication may not strictly be called a bulletin, it will, nevertheless, allow a little more freedom in communicating to the members of the society notices or items of general geographic and personal interest which might otherwise escape attention or record.

In answer to a question put by Sir Philip Magnus, it was recently stated by Mr. Hemins in the British House of Commons that "the Committee of the Privy Council for Scientific and Industrial Research are in the course of their administration collecting information as to research being conducted in various places and different types of institution which can not but facilitate the coordination of research work which the honorable member desires. Moreover, as he will have gathered from the annual reports of that department, similar organizations have come or are coming into existence in other parts of the empire which are in close relation with the research department in this country. As an example of what is being done in the oversea dominions, I would refer to the report of the Commonwealth Advisory Council of Science and Industry and the recently published South African Journal of Industries, which may be seen in the Colonial Office library. This imperial machinery will enable those who are engaged in our colonial trade and in our productive industries to become acquainted with the problems arising in different parts of the empire, and with the results of any researches now in progress either here or in the dominions. The establishment of research associations, which is one of the main objects of the Research Department, is intended to place at the service of our manufacturers scientific experts who may advise them or conduct in their factories special investigations."

The fourteenth annual conference of the Council on Medical Education was held at the Congress Hotel, Chicago, Monday, February 4, 1918. The morning program was devoted to medical education, and was as follows:

Opening of the conference, Dr. Horace D. Arnold, chairman, Council on Medical Education, Boston.

"Recent progress in medical education," Dr. Nathan P. Colwell, secretary, Council on Medical Education, Chicago.

"Problems of administering entrance requirements," Professor George Gailey Chambers, director of admissions, University of Pennsylvania, Philadelphia.

"The student's clinical course in medicine," Dr. George Dock, professor of medicine, Washington University Medical School, St. Louis.

"Some problems in medical education resulting from the war," Major Horace D. Arnold, M.R.C., U. S. Army, Boston.

In the afternoon the session was held jointly with the Federation of State Medical Boards of the United States, and dealt with the general topic of medical licensure, as follows:

"A central cooperative bureau of information," Dr. David A. Strickler, president, Federation of State Medical Boards of the United States, Denver.

"The civil administrative code of Illinois, and medical licensure," Francis W. Shepardson, director, Illinois Department of Registration and Education, Springfield.

"The general problem of the minor forms of healing," Hon. Howell Wright, state senator of Ohio, Cleveland.

"Sectarianism in the science of healing as treated in legislative acts and judicial decisions," Harry Eugene Kelly, formerly attorney for the

Colorado State Board of Medical Examiners, Chicago.

Tuesday, February 5, separate meetings were held by the Federation of State Medical Boards of the United States and the Association of American Medical Colleges.

Nature states that on January 2 the Institution of Civil Engineers of Great Britain completed the hundredth year of its existence, having been established in 1818 at a meeting of eight engineers at the Kendal Coffee House in Fleet Street. At the meeting of the institution on January 8, before the discussion of papers, a statement commemorative of the founding of the institution was made, present conditions precluding a more formal celebration of the centenary.

THE United States Bureau of Mines has broadened the scope of its station at Urbana, Ill., to include work in coal and metal mining and the metallurgical industries of the Middle West. The present safety work will be continued and all work will be conducted under a cooperative agreement with the mining department of the University of Illinois. The bureau staff is under the superintendence of E. A. Holbrook, supervising mining engineer and metallurgist. Other members are W. B. Plank, in charge of mine safety, and F. K. Ovitz, chemist.

IT is expected that the new Field Museum, Chicago, for which ground was broken in the summer of 1915, will be ready for the transfer of the contents of the old museum in Jackson Park by August, 1919. The new building is situated south of Twelfth Street and east of the Illinois Central Station. It is of Georgia marble, and, exclusive of the porticoes, will measure 756 feet long and 350 feet wide. It will cost $5,000,000.

THE annual report of the Bristol Museum and Art Gallery, lately published, shows great activity, in spite of the war. During the year 261,594 persons visited the museum. An important new development was in connection with wounded soldiers. Some of the collections were temporarily placed in storage and space was made for a recreation center, including frequent lectures and demonstrations, concerts, library facilities and light refreshments.

THE Minnesota state entomologist has issued an illustrated report of thirty-six pages on work upon the pine blister rust in Minnesota during 1917, in cooperation with the United States Bureau of Plant Industry. Details of inspection, scouting, infections and eradication are given. A limited number of copies are available for distribution. Applications should be mailed to State Entomologist, University Farm, St. Paul, Minnesota.

UNIVERSITY AND EDUCATIONAL NEWS

BONDS and cash amounting to $1,693,000 representing the trust fund established by Drs. Charles H. and William J. Mayo, Rochester, for carrying on medical research work at the University of Minnesota, have been turned over to the state treasurer.

BY the will of the late Mrs. Charles H. Colburn, of Milford, Mass., a fund of $100,000 is bequeathed to the Harvard Medical School for research in tuberculosis.

COLUMBIA UNIVERSITY has received $3,000 for research work in war problems from an anonymous donor and $5,000 from Clarence Mackay for surgical research work.

W. H. BENDER, associate professor of agricultural education at the University of Minnesota, has resigned to go to the State Agricultural College, Ames, Iowa, as director of vocational education and special supervisor of vocational agriculture.

AT the University of Iowa, Associate Professor R. P. Baker has been made acting head of the department of mathematics. Mr. R. E. Gleason and Mr. F. M. Weida have been appointed instructors in mathematics.

DISCUSSION AND CORRESPONDENCE

THE ELECTION OF OFFICERS BY SCIENTIFIC SOCIETIES

TO THE EDITOR OF SCIENCE: In these days of strife for democratic ideals I would like to raise the question whether the method of election followed by many of our scientific societies is not in need of democratization. To begin at home I may say that I have been

a member of the American Association for the Advancement of Science for twenty years and I think I was consulted only once in regard to a suitable candidate for the presidency of this Association. As far as I know the presidents of this Association have always been selected properly and the selections have perhaps been better than they would have been if a more democratic method had been employed, but it is questionable whether the scientific public of America takes as deep an interest in its leading scientific men as it would have taken if it had really had a part in bestowing a high scientific honor on some of them.

I have been a member of the Society of the Sigma Xi for about twenty years and do not think I have ever had any part in the selection of a candidate for national president, although I voted once or twice for the one who was nominated by a committee. It may be said that I could have wielded an influence in the selection of candidates for these high offices if I had wanted to do so but many of us have so many duties to perform that we seldom go outside this range of interests. The question is whether it should not be put in such a way that a much larger number of the scientific men would regard it as a part of their duty to take an active part in the bestowal of high scientific honors. If this is not done these honors will usually be bestowed by a few men who will generally make wise selections but will fail to arouse much general interest.

In some of the national societies devoted to special subjects there seems to be still greater need for thoroughly democratic methods of election in case we are seeking to establish in America a real democracy along these lines. Many of us regard elections as necessary evils which should receive the least possible attention. There are various other means of expressing scientific appreciation and a scientific democracy should by no means be judged mainly by the methods employed in the selection of officers. These methods have, however, their influence in creating a spirit of openness and wide interest, and it is at least conceivable that the extra labor involved in making scientific elections more democratic would be wisely spent. G. A. Miller

ARE ZOOLOGISTS GOING TO USE THE BNA?

It is perhaps as justifiable as it is interesting that scientists are the slowest people to take hold of new ideas and radical changes. Yet there seems to be little justification for a group of men remaining silent and at the same time failing to use modern inventions in their field which have proved useful and effective.

Most zoologists are familiar with the excellent work of the Commission from the Anatomical Society which undertook the revision of the nomenclature of human anatomy. It must be a great source of satisfaction to this body of men to see how well the anatomists have responded to the simplification and standardization of terms, for now all the textbooks and many of the medical men have adopted the BNA, making a bedlam of terms easy to understand.

However, up to the present time the comparative anatomists and zoologists in general have not adopted or used this nomenclature, so that one may read of the "dorsal root" of a spinal nerve in a pig embryo and the "posterior root" of a spinal nerve in human anatomy. Indeed the workers in the field of human embryology still use terms which do not appear in the BNA.

Perhaps the most confusing set of terms are the following: anterior and posterior; dorsal and ventral, and superior and inferior. It would seem preferable to use drosal and ventral instead of anterior and posterior and then use anterior and posterior to mean superior and inferior, for there seems to be no particular need for upsetting the whole of the comparative terms to accommodate only one type of animal. But this is not a matter for one individual to decide and since the Commission has decided differently and their report has been accepted and adopted, there seems to be but one thing to do, and that is follow their nomenclature. If the zoologists wish to use the words "dorsal and ventral"

they should furnish sufficient grounds to justify changing the BNA, but if on the other hand they can not, or rather will not, then it follows that they should use the terms as they stand in the BNA.

If we are willing to stand so firmly in the principles of evolution and if we recognize man as but another animal in the long series, it seems entirely justifiable to use the same terms throughout for homologous structures, and certainly for the general space positions and orientations.

Perhaps an open discussion of the matter might be of some interest and effect; concessions might be made on both sides which will give happy results.

THOMAS BYRD MAGATH
COLLEGE OF MEDICINE OF THE
UNIVERSITY OF ILLINOIS,
CHICAGO, ILL.

RATE OF DESERT DELTA GROWTH

FROM the presence and position of the alluvial fans which so conspicuously mark some of the old shore-lines of ancient Lake Bonneville, that gigantic precursor of the Great Salt Lake of Utah, it is inferred that during the long period of desiccation which that vast water-body underwent the lowering of the lake level did not take place uniformly but experienced more or less protracted pauses. The most notable of these supposed halts in the recession of the waters is thought to be represented by the embankment denominated the Provo Beach.

The Provo terrace, which lies about 600 feet above the surface of the present Great Salt Lake, and 400 feet below the highest water stage of the ancient lake, is distinguished by extensive alluvial cones which are commonly regarded as true delta deposits. The great magnitude of some of these deltas is interpreted as furnishing conclusive evidence of long tarrying of the old lake waters at this level.

That the unusual size of the Provo deltas is not a necessary consequence of long lagging of lake waters at this stage seems demonstrated by recent extensive observations that enable quantitative calculations to be made of the actual time occupied in desert delta formation. The possible rapidity proves to be very much beyond all ordinary expectations. Concerning the formation of the Provo deltas there are several accelerating factors which do not obtain in the normal desert fans of alluvium that so often collect on the piedmonts at the mouths of canyons. These are the great volumes of nearby morainic materials which filled the valleys of the Wasatch and other ranges, the presence of a convenient water-body in which to concentrate the débris washed out of the canyons, and the position of the Provo level on the line where plain meets mountain.

The alluvial fans characterizing the piedmonts of many desert ranges are usually small, owing largely to the fact no doubt that the mountains have little soil material or coarse rock-waste. In some instances the alluvial débris forms merely a thin veneer over a low cone of the rocky substructure. The out-wash of boulders and pebbles serves rather as a protection against the general lowering of the plains surface through eolian erosion. Not a few of the desert fans have thus really a rock floor just as have the intermont plains themselves, and are not, strictly speaking, alluvial cones at all.

In strong contrast are the desert fans sometimes produced by normal water action. Two instances in particular may be cited in illustration of the actual rapidity with which the process sometimes goes on. Near Ivanpah, in southeastern California, a shallow trench was once dug diagonally down a sloping bajada belt in order to protect a railroad grade from possible wash of sporadic rains. Soon a cloudburst happened to come. In an hour's time a great gully 75 feet deep, 50 feet wide and several miles long was excavated in the soft soil. The bulk of the dirt was redeposited at the foot of the sloping plain in a broad fan of more than a mile radius. In another instance, near Socorro, New Mexico, the bank of an arroyo was cut to take care of future storm-waters. In a single night this spillway was deepened to 50 feet and an alluvial cone nearly 100 feet high and nearly three miles radius was formed.

It is possible and often probable that desert deltas of great size are surprisingly rapid in their growth. When chanced to be restricted by quiet bodies of water, as in the case of old Lake Bonneville, they are rendered so exceptionally conspicuous as to excite wonderment. Therefore the Provo deltas do not necessarily imply very long, or even any, tarrying of Bonneville lake surface at this level. It is possible and even probable that these deltas were actually formed during the regular or uniform recession of the lake waters. Desert delta growth may take place with unexpected rapidity, measurable by days or even hours rather than eons.

Charles Keyes

SCIENTIFIC BOOKS

The Botany of Crop Plants. A text and reference book. By Wilfred W. Robbins. P. Blakiston's Son & Co., Philadelphia, 1917, pp. xix + 681, *f. 263.* Price $2.00.

The Botany of Crop Plants, by Wilfred W. Robbins, of the Colorado Agricultural College, is an important contribution to our text-books on economic botany. The book has been written to meet a growing demand for a text and reference book which will give the student a knowledge of the botany of common orchard, garden and field crops. To the teacher who is engaged in the teaching of botany, especially the economic phase of the subject, the work of Dr. Robbins will be found of great value.

It has been difficult to refer students to a single text-book giving an adequate discussion of this phase of botany. Botanists are to blame themselves for allowing the economic side of the subject to slip away from them. This book should, therefore, pave the way for a more adequate study of our crop plants from the standpoint of agriculture and horticulture. Botanists should make use of our cultivated plants when it is possible to utilize them to illustrate life processes.

The text-book of Dr. Robbins is divided into two parts; Part I., consisting of 8 chapters, takes up such topics as the fundamental organs of seed plants; the cell, root, stem, leaf, flower, fruit, seed and seedling, classification and naming of plants. When possible the author has used economic plants as a basis for the discussion. This portion of the text is brief, covering only 67 pages. In Part II. the author has arranged the subject from a systematic standpoint. Chapters IX.—XIX. inculsive are devoted to the grasses, first importance being given to the cereals, wheat, oats, barley, rye, maize, sorghum, rice, millet, timothy and sugar cane. Under the subject of wheat he discusses the habit of the plant, root, stem, leaf, inflorescence, spikelet, flower, pollination, artificial cross pollination, fertilization and maturing of grain, ripening stages, the mature grain, *e. g.,* ovary wall or pericarp, testa, nucellus, endosperm, aleurone layer, starchy endosperm, embryo. The author follows this botanical matter with economic phases of the subject as hard and soft wheats, millings of wheat, kinds of flour, germination of wheat, etc. He then discusses the classification of wheats, origin of wheat, environmental relations. In the bibliography some 29 references for purposes of study are referred to. The papers for the most part are accessible. One wonders why the work of Körnicke "Die Getreidearten", which is one of the best of the older works on the subject, is not referred to. However, the student will find the references given valuable in looking up material. Each one of the other cereals is taken up in the same way.

A short chapter is devoted to timothy. It would have added to the value of this chapter if some of the other forage grasses had been considered, say blue grass, which is the most important pasture plant of the northern states. This review would be unduly lengthened, should I refer to the other economic plants he has considered. Mention may, however, be made of the treatment found under the head of Moraceæ, in which the mulberry, hop, fig and hemp are taken up. In the account of the fig there is an adequate statement on pollination. This chapter, like others, gives some important references. In some cases, however, some important references are omit-

ted, as in the bibliography of the cucurbits. The author has made a most useful book and it should stimulate botanists to get some of the old lines of work back into botany, rather than let it continue to be taught by men who have other lines of interest, than botany. The book is therefore a most welcome addition to our literature of practical botany.

L. H. PAMMEL

IOWA STATE COLLEGE,
AMES, IA.

The Genera of Fishes, from Linnæus to Cuvier, 1758–1833, Seventy-five Years, with the accepted Type of Each. A contribution to the Stability of Scientific Nomenclature. By DAVID STARR JORDAN, assisted by BARTON WARREN EVERMANN. (Published by Stanford University, 1917.)

It is a reproach to zoologists that so much uncertainty exists about the proper names of animals. To an outsider it appears inexplicable that the numerous competent students of taxonomy do not put their house in order, and settle once for all the questions which they find so vexatious. The difficulty is that these matters demand exhaustive bibliographical research, and few have access to the necessary books, even if they could afford to take the time to digest them. Proposed changes, based on fragmentary research, are naturally regarded with doubt, since other investigations may show them to be needless. The only satisfactory solution must come through reviews of the whole of the pertinent literature of any group under discussion. Such a review, so far as it concerns the genera of fishes named from 1758 to 1833, is given by Dr. Jordan in a work just published by Stanford University. The various publications are enumerated in chronological order, and all the new generic names are cited, with indications of the type species. Explanatory notes, often of considerable length, are added. Thus the reader is put in possession of the facts, and is at liberty to form his own opinions. The list is doubtless substantially complete, although it is stated in the introduction that other names may yet be discovered in dictionaries and obscure publications.[1] At the end is a series of lists, showing the various necessary or possible changes in nomenclature. These lists are as follows:

(*A*) Changes resting in priority, involving 73 names, though in nine of these the generic name remains as currently accepted, only the authority being altered. It is greatly to be regretted that our common genus of darters, *Etheostoma* of all modern authors, must apparently be called *Catonotus*. The names adopted from A. F. Röse (1793) appear to me to be of doubtful validity, being mere transliterations of the Greek names of Aristotle. The work itself being in Latin, the Aristotelian names were given with Latin equivalents. The matter is of importance to entomologists as it involves the name *Phycis*, used at present for a genus of moths, the type of a subfamily.

(*B*) Changes resulting from the operations of opinions 20 and 37 of the International Commission, admitting the names of Gronow. Those of Klein are held to be equally valid or invalid. These authors do not use the Linnean binomial system, and Dr. Jordan questions the validity of the names. In spite of the opinions of the Commission, it appears evident that all these names should be rejected.

(*C*) Changes resulting from opinion 24 of the Commission, which if logically followed must also admit four names of Plumier. The Plumierian names were polynomial and we must agree with Dr. Jordan that they should be rejected. Although few, they involve some very objectionable changes.

(*D*) Hypothetical changes according to law of priority, but doubtfully eligible; apparently to be rejected under opinion 57 of the Commission.

[1] I hear from Dr. Jordan that he has found two omissions: *Congiopodus* Perry, 1811, the same as *Agriopus;* and *Rhomboides* Goldfuss, 1820, a substitute for *Rhombus* Cuvier, preoccupied.

(*E*) Changes as under *D*, but the names (of Catesby) perhaps to be regarded as Latin vernaculars.

(*F*) Changes in accord with the law of priority, but questionable on account of irregularities. These include various Arabic names of Forskal, used for divisions of genera.

(*G*) Changes due to so-called preoccupation by earlier, *nearly* identical words. These I think should be rejected as needless, following the opinion expressed in former years by Dr. Jordan and others.

(*H*) Questionable cases, similar to *G*.

Whatever we may think of all these cases, we must agree with Dr. Jordan that it is of prime importance to have them decided as soon as possible. The matter concerns all working zoologists, and these, now that they have the facts before them, should endeavor to form and express definite opinions.

The printing and appearance of the book are admirable, but it is unfortunate that the soft paper is unsuited for annotations in ink.

T. D. A. Cockerell

SPECIAL ARTICLES

THE "RAWNESS" OF SUBSOILS[1]

In his communication to Science for September 21, 1917, Dr. C. B. Lipman has raised the whole question of the relative "rawness," or unproductivity, of subsoils by putting forward the view, based upon his own observations of plant growth upon arid subsoils, that these are but little, if at all, less "raw" or unproductive than those of humid regions. In suggesting that soil investigators do not generally appreciate the facts which support such a view he states the case too mildly. Judging from their published statements they do not even suspect the existence of such facts, emphasizing as one of the most striking characteristics of the subsoils of arid regions the ability of these, when first thrown out of excavations or simply exposed by grading operations, to support a satisfactory growth of non-leguminous plants as well as of legumes. I am aware of no book or article, previous to that just referred to, in which a contrary view is expressed. This characteristic of arid subsoils, in contrast with those of humid regions, is emphasized in all text-books which refer to the matter at all, as illustrated by the following list of references:

1. "The Soil," by F. H. King, 1904, p. 29.
2. "Soils," by E. W. Hilgard, 1906, p. 163.
3. "The Principles of Soil Management," by T. L. Lyon and E. O. Fippen, 1909, p. 69.
4. "Bodenkunde," by E. Ramann, 1911, p. 527.
5. "Principles of Agricultural Chemistry," by G. S. Fraps, 1913.
6. "Soils, their Properties and Management," by T. L. Lyon, E. O. Fippin and H. O. Buckman, 1915, p. 82.
7. "Die Bodenkunkolloide," by P. Ehrenberg, 1915, p. 164.

The view that the characteristic subsoils of arid regions are lacking in rawness appears to be based almost entirely upon the observations of the late Dr. E. W. Hilgard, who, in 1892, first called attention to the matter, mentioning the following example:

> In the case of a cellar 7 to 10 feet deep, near Nevada City, California, the red soil-mass dug out was spread over part of a vegetable garden close by, and, as a venture, the annual vegetables—tomatoes, beans, watermelons, etc.—were sown just as usual. They not only did well, but better than the portions not covered, which had been cultivated for a number of years and were somewhat exhausted thereby.[2]

F. Wholtmann, of Halle, who in the early years of the present century made several visits to California, later expressed the same view, but it is not clear to what extent his conclusions were based upon his own observations, he having discussed the matter with Hilgard while in America. The common tendency to take Hilgard's conclusions on such matters as the final word is well illustrated by Ehrenberg, of Göttingen, who, in his very recent book included in the above list, mentions that

[1] Published with the approval of the Director as Paper No. 96, of the Journal Series of the Minnesota Agricultural Experiment Station.

[2] U. S. W. B. Bul. 3, p. 19.

during his many years of investigation he (Hilgard) had become the best judge of the differences of soils of humid and arid regions (p. 164).

This remarkable property of arid subsoils, repeatedly emphasized by Hilgard in his various publications and mentioned in the works of other investigators from the time of the appearance in 1904 of the late Dr. F. H. King's "The Soil" (p. 29), must surely have excited the interest of botanists, geologists and irrigation engineers as well as of agricultural investigators, not only in California, but also in arid lands on other continents. Yet until the present observations of Dr. Lipman no word of criticism has appeared.

The accepted view, in brief, has been that on the freshly exposed subsoils in humid regions inoculated legumes as well as non-leguminous plants fail to make a satisfactory growth, one at all comparable with that on adjacent surface soils, while under similar conditions in arid regions the subsoil may be expected to show practically as good a growth as adjacent surface soil. The question of the *maintenance of productivity* in the case of the non-legumes on the arid subsoils has not been raised, interest centering upon the initial performance of the freshly exposed material. With the humid subsoils the "rawness" understood has not been absolute sterility, as Lipman appears to assume, but a low productivity. Lipman recognizes and confirms by his own observations the productivity of arid subsoils toward inoculated legumes, but denies that non-legumes make any satisfactory growth on these. While recognizing the characteristic sterility toward non-legumes of subsoils of humid regions he doubts the existence of any proof that inoculated legumes will not grow on humid subsoils. He uses the term "grow" but, as the whole question is whether the plants "thrive" and not whether they are barely able to make a weakly, stunted growth, it is desirable to discuss the matter as though "thrive" had been employed. In short, he considers "the lack of available nitrogen probably is sufficient to account for the rawness of subsoils" of both humid and arid regions toward non-leguminous plants and questions the existence of any rawness in the case of inoculated legumes.

While the views current upon the subsoils of arid regions may be due to Hilgard alone, those upon the subsoils of humid regions are founded upon the observations of numerous investigators in Europe as well as in America. Many of these may antedate 1886, the year in which Hellriegel established the rôle of symbiotic bacteria in the growth of legumes, but in the thirty years that have since elapsed it is surprising that none from among the hundreds of agricultural investigators in humid regions has called attention to the earlier false explanation, if the failure of such crop plants on exposed subsoils were due only to the lack of inoculation. The universally accepted idea of the rawness of humid subsoils in general is based not upon pot experiments or upon the growth of plants upon subsoils exposed by grading operations or thrown up from excavations, but upon observations of the growth of the crops in fields where the plow had unwisely been run a few inches below the usual depth of cultivation, with the result that the fields for years after had shown in their lessened crop returns the unproductivity of the subsoil brought to the surface. In view of the almost universal distribution of red clover in western Europe and in the humid states of this country the necessary bacteria could rarely have been missing. If the rawness were due simply to lack of inoculation such deeply plowed fields might be expected to have shown, when sown to small grains with the usual accompaniment of clover seed, a remarkably vigorous growth of the legume accompanying the failure of the cereal, a phenomenon which could scarcely have escaped mention.

In the very article by Alway, McDole and Rost,[3] which has called forth the statements of Lipman, such a phenomenon has been described. The field of 5 acres is in a railway cut near Blair, Nebraska, where about 17 years previously the surface material had been removed to an average depth of 25 feet. It had never been manured or seeded to a legume crop, but for several years had been planted to

[3] "Soil Science," Vol. 3, p. 9, January, 1917.

corn and sorghum without producing a satisfactory crop, and, in 1912, the first year it was visited by the authors, the crop of corn was not worth gathering. The next spring the west half of the field was seeded to alfalfa alone, but the east half to oats with alfalfa. As at both ends the field extended beyond the cut so as to include undisturbed ordinary black surface soil there was a chance to compare the growth of the two crops on the exposed yellow subsoil with that on ordinary surface soil. The whole of each half had been seeded by the same man, at the same time and with the same seed. When visited in July the alfalfa on both was found fully inoculated; on the portion seeded without nurse crop it was practically as good as on the black surface soil, but on the other half of the field marked differences were shown by subsoil and surface soil. The oats on the former were yellowish-green in color, with short straw and poorly filled heads, while on the latter they were dark green and tall with well filled heads; the alfalfa on the exposed subsoil showed a good stand and the plants were almost as large as where seeded without a nurse crop, but on the surface soil they were few in number and small, evidently having succumbed to the oats in competition for moisture.

In his communication Dr. Lipman appears to have made the mistake of considering the Nebraska subsoils involved in our field observations as semi-arid. We regard them as strictly humid as pointed out in earlier papers of the series. Further, he considers them representative of all Nebraska subsoils; a view for which there appears no justification. They represent only the loess subsoils of eastern Nebraska. He is in error in stating that we claim legumes will not grow on subsoils of humid regions. On the contrary, while we pointed out that the "rawness" of humid subsoils toward legumes as well as non-legumes is generally assumed by soil investigators, the burden of our paper was to prove that in the case of the loess subsoils of the humid portion of eastern Nebraska there was no rawness toward inoculated legumes. We offered no evidence and made no claims as to the rawness of any subsoils other than those of the loess region of Nebraska. A forthcoming paper by Mr. P. M. Harmer, of this laboratory, will deal with the growth of alfalfa on subsoils from widely separated points in Minnesota, a humid state.

In one of his last articles (1912) Hilgard mentioned a heap of subsoil at Berkeley, excavated from a depth of over twelve feet, which had become covered with a thick stand of grasses and weeds of all kinds. Lipman suggests that this may have consisted of surface material which had been buried in previous cutting operations. A very similar, but evidently distinct example is furnished in a letter which the writer received from Hilgard in May, 1907.

> Last winter a foot-ball field was excavated here (Berkeley) to a depth of 16 feet at one end, and a bank of yellow-brown clay was thrown up on the surface 6 feet high. Now I find this clay almost covered with a growth of the usual weeds whose seeds were blown there by the high winds. Sherry and dock are most luxuriant, but oats, barley and ray grass are also as common as on the surface soil adjacent. I remember a similar clay pile at my old home in Illinois where nothing ever grew in ten years after it was dug out of the cellar.

Doubtless there are many in California and in other arid lands who have valuable observations upon the subject which should be published. No one appreciated the value of such more than did Hilgard, who, in the letter quoted above, inquiring as to the growth of plants on exposed subsoils in western Nebraska, wrote:

> Such observations as that are just as valuable as if a special expedition had been sent out by the Carnegie Institute. Please do not forget to have them gathered up while your state is young, for they will be much more difficult latter. Field observations under normal conditions by experienced investigators are far more cogent than any number of vegetation or pot experiments.

It is to be hoped that any extant records of such observations on California and other arid subsoils will soon be published.

F. J. Alway
University of Minnesota

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORT OF THE TREASURER FOR 1917

In conformity with Article 15 of the constitution and by direction of the council, the treasurer has the honor to submit the following report for the period December 20, 1916, to December 15, 1917, both inclusive.

The total of cash receipts during the year was $7,620.42. Disbursements made in accordance with directions of the council amounted to $12,127.45. These include $8,000 for purchase of a like amount of United States Second Liberty Loan Bonds of 1917 for the association and held as an investment.

The total amount of funds of the association, consisting of cash, cost value of securities purchased and appraised value of securities received from the Colburn estate is $112,644.18

A detailed statement is appended.

(Signed) ROBERT S. WOODWARD,
Treasurer

December 15, 1917

BALANCE SHEET

Assets

Investments:		
Securities (Exhibit *A*)		$108,777.50
Cash in banks		3,866.68
		$112,644.18

Liabilities

Funds:		
Life Membership		$16,400.00
Jane M. Smith Fund		5,000.00
Colburn Fund		77,755.74
		$99,155.74
Accrued surplus		$13,488.44
		$112,644.18

CASH STATEMENT

Receipts

1916		
Dec. 20		
Balance from last report		$8,373.71
Interest from securities	$4,905.00	
Interest from bank balance	320.42	
20 life commutations	1,000.00	
E. D. Adams	950.00	
C. H. Dodge	445.00	$7,620.42
		$15,994.13

Disbursements

Investments:		
$8,000 U. S. Second Liberty Loan of 1917		$8,000.00
Interest on Life Memberships:		
284 members ($14,200 at 4%) for 1916	568.00	
328 members ($16,400 at 4%) for 1917	656.00	
4 members (Jane M. Smith Fund)	200.00	$1,424.00
Grants:		
Ralph C. Benedict	$100.00	
R. S. Woodworth	100.00	
F. C. Blake	100.00	
Richard C. Tolman	300.00	
H. L. Fairchild	300.00	
S. W. Williston	100.00	
Ralph W. Cheney	100.00	
Frederick P. Gay	500.00	
John B. Watson	100.00	
Robert M. Yerkes	100.00	
A. Hrdlička	100.00	
Bruno Oetteking	100.00	
Herbert M. Richards	250.00	
C. H. Kauffman	100.00	$2,350.00
Subcommittee of 100:		
J. McKeen Cattell (printing)	153.45	
J. C. Merriam, Chairman	200.00	$353.45
		$12,127.45
Cash in Banks:		
Fifth Avenue Bank of New York	1,853.89	
U. S. Trust Company of New York	2,012.79	3,866.68
		$15,994.13

[Exhibit A]

SCHEDULE OF SECURITIES

Securities Purchased

Par Value	Purchase Value
$10,000 Chicago and Northwestern Railway Co., general mortgage 4 per cent. bonds, due 1987	$9,425.00
$10,000 Atchison, Topeka and Santa Fe Railway Co. general mortgage 4 per cent. bonds, due 1995.	9.287.50
$10,000 Great Northern Railway Co. first and refunding mortgage 4.25 per cent. bonds, due 1961.	10,050.00
$10,000 Pennsylvania Railroad Co. consolidated mortgage 4.5 per cent. bonds due 1960	10,487.50
$10,000 Chicago, Burlington and Quincy Railroad Co. general mortgage 4 per cent. bonds, due 1958.	9,350.00
$10,000 Union Pacific Rail-	

road Co. first lien and refunding mortgage 4 per cent. bonds, due 2008...	9,012.50	
$10,000 Northern Pacific Railway Co. prior lien railway and land grant 4 per cent. bonds due 1997.	9,187.50	
$10,000 New York Central and Hudson River Railroad Co. 3.5 per cent. bonds, due 1997.....	8,237.50	
$8,000 U. S. Second Liberty Loan Bonds.....	8,000.00	$83,037.50

Bonds from Colburn Estate

Par Value	Appraised Value	
$20,000 Acker, Merrall and Condit Co. debenture 6 per cent. bonds	$13,600.00	
$7,000 Buffalo City Gas Co. first mortgage 5 per cent. bonds	1,540.00	
$8,000 Park and Tilford Co. sinking fund debenture 6 per cent. bonds	6,400.00	
$42,000 Pittsburgh, Shawmut and Northern Railroad first mortgage 4 per cent. bonds, due February 1, 1952.....	4,200.00	$25,740.00
$165,000		$108,777.50

I certify that I have audited the accounts of the treasurer of the American Association for the Advancement of Science for the period December 20, 1917, to December 15, 1917; that the securities representing the investments of the association have been exhibited and verified; and that the income therefrom has been duly accounted for.

The financial statements accompanying the treasurer's report are in accord with the books of the association and correctly summarize the accounts thereof.

(Signed) Herbert A. Gill,
Auditor

Dated December 19, 1917

L. O. HOWARD, PERMANENT SECRETARY, IN ACCOUNT WITH THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

From November 1, 1916, to October 31, 1917

Dr.

To balance from last account:		$3,836.43
To receipts from members:		
Annual dues, 1917.....	$37,818.00	
Annual dues, 1918.....	158.00	
Annual dues, previous yrs.	333.00	
Admission fees	2,085.00	
Associate membership fees.	12.00	
Life membership fees....	2,400.00	$42,806.00
To other receipts:		
Sale of publications	$45.05	
Miscellaneous receipts, including Treasurer's payment of Science subscriptions for life members, interest, postage from foreign members, sale of programs, etc	1,364.40	$1,409.45
		$48,051.88

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By publications:		
Publishers Science.....	$24,391.77	
Preliminary announcement, circulars, forms, etc.	1,644.91	$26,036.68
By expenses New York meeting:		
Sectional secretaries, commutations, accounts, etc.		920.79
By expenses Pacific Division:		
Salary of Assistant Secretary	1,200.00	
Allowance for extension and office expenses.....	603.00	1,803.00
By expenses Washington Office:		
Salary of Permanent Secretary	$1,500.00	
Salary of Assistant Secretary	1,500.00	
Extra help	1,905.75	
Postage	1,115.80	
Office supplies	180.75	
Express, telephone and telegrams	71.30	$6,273.60
By propagandist work.....		3,795.46
By miscellaneous expenditures:		
To Treasurer, life membership fees	$1,000.00	
To Treasurer, gifts from members	1,395.00	
Refund of dues	50.00	
Committee on Research...	15.74	
Committee on Delegates ..	10.50	
Committee on Organization and Membership..	11.85	$2,483.09
By balance to new account		$6,739.26
		$48,051.88

The foregoing account has been examined and found correct, the expenditures being supported by proper vouchers. The balance of $6,739.26 is with the following Washington,

American Security & Trust Co.....	$2,281.42
American National Bank of Washington	2,031.84
American National Bank of Washington (Savings Department)	2,426.00
	$6,739.26

Herbert A. Gill,
Auditor

Washington, D. C.,
December 24, 1917